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Joining Innovation

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Making Buy American Viable: *The High Speed Rail Manufacturing Center*

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Leading an initiative to help Ohio and Midwest Manufacturers and their workers successfully compete for opportunities and jobs in the emerging high speed rail supply chain.

About EWI

- Core business is manufacturing technology development and insertion for high consequence applications
- 200+ industry/govt. customers with over 3,000 locations
- Annual Revenue $25M; 500+ projects; 7,000 visitors
- 130,000 ft^2 facility; $30+ M in capital equipment
- Strong long-term linkages with research institutions, universities and trade groups
- 135 employees
- Active on 40+ professional and standards committees

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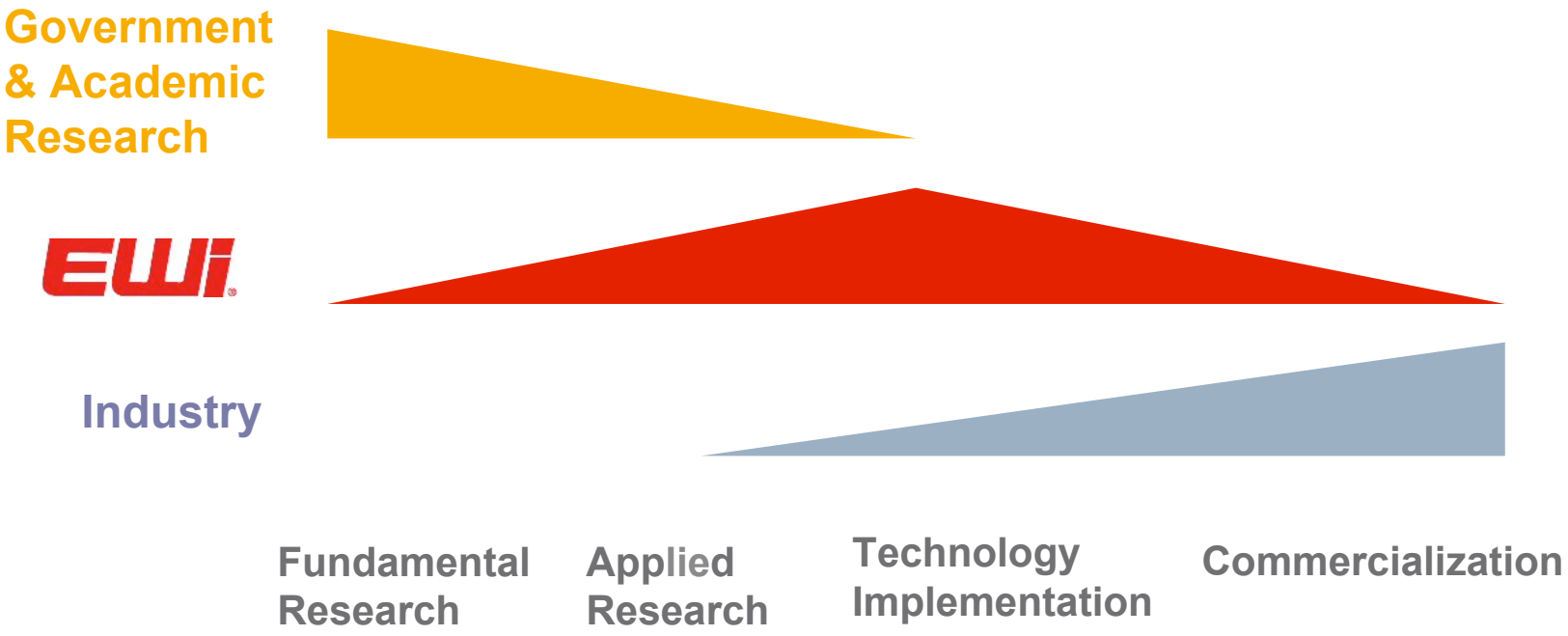
EWI's Unique Role in Advancing Manufacturing Technology



Hundreds of member companies at thousands of sites

- ABB Ltd. Flexible Auto.
- ABS Americas
- Accuride Corporation
- Acergy Group
- AeroMet
- Aghajari Oil & Gas Production Co.
- Air Liquide
- Air Products
- Airbus
- AK Steel
- Aker Kvaerner
- Albany International
- AlcoTec Wire Corp
- Allen Diesels
- Alstom Power
- American Hydro Corporation
- AO Smith Corp.
- ARCO
- Babcock & Wilcox
- BAE Systems
- Bechtel
- BOC Gases
- Boeing
- Boston Scientific
- BP
- BWX Technologies
- Caterpillar
- Chevron
- Chrysler
- Cleveland Cliffs Mining
- ConocoPhillips
- CRC Evans
- Curtiss-Wright
- Delphi Powertrain
- Det Norske Veritas
- Dow Chemical
- Dresser-Rand
- DuPont
- EG & G
- Elliott Turbomachinery
- Emerson
- ESAB
- ExxonMobil
- Fluor Daniel
- Foster Wheeler
- Ford Motor Co.
- FuelCell Energy
- General Electric Company
- General Motors Corporation
- General Dynamics
- GKN Aerospace
- Goodrich Corp
- Guidant
- Hamilton Sundstrand
- Honda of America
- Hitachi America
- Hydro Aluminium
- Ingersoll-Rand
- ITW-Illinois Tool Works
- JC Bamford
- Johnson Controls
- Joy Global
- Kawasaki Heavy Industries
- Kellogg Brown & Root
- Knolls Atomic Power Laboratory
- Kobelco Welding of America
- Kuwait National Petroleum
- L-3 Communications
- Liebert Corporation
- Lincoln Electric Co.
- Liquid Air Corp.
- Lockheed Martin
- Los Alamos National Laboratory
- Mack Trucks
- Marathon Oil
- McDermott Inc.
- Medtronic Inc.
- Micro Motion, Inc.
- Mitsubishi Heavy Industries
- NASA
- Naval Surface Warfare Center

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Leveraged Collaboration
EWI's Proven Public/Private Partnerships

- Edison Technology Center
- US Navy Joining Center
- Edison Center for Advanced Energy
- DOE – Advanced Energy Manufacturing Center
- NFC – Nuclear Fabrication Consortium
- AMC – Additive Manufacturing Consortium

The Capacity to Manage Railroad Sized Projects

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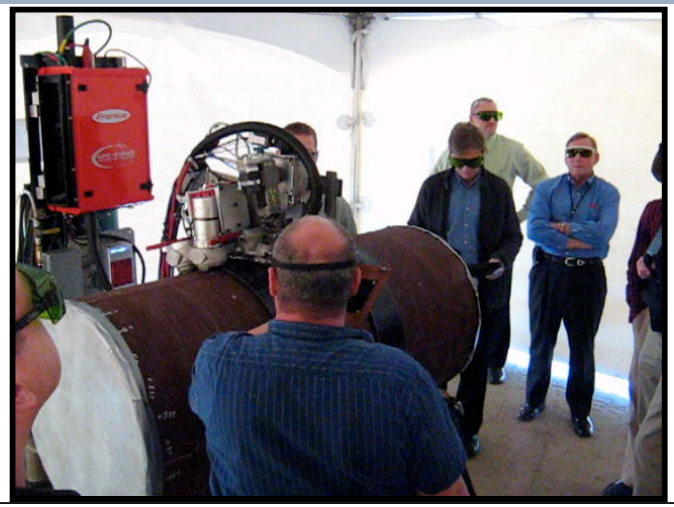
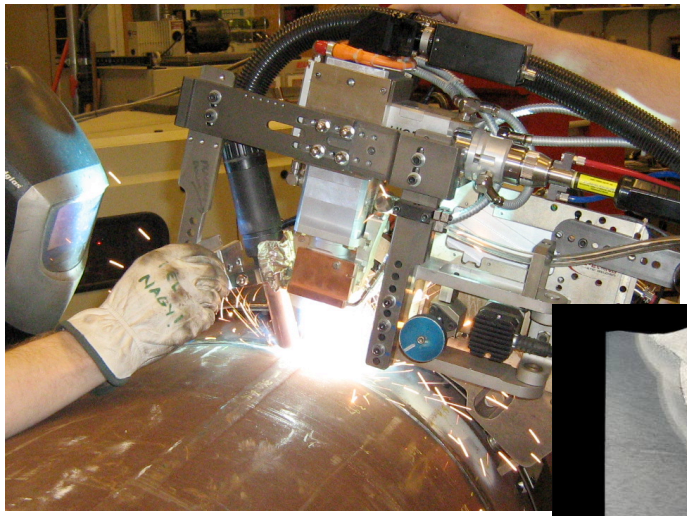
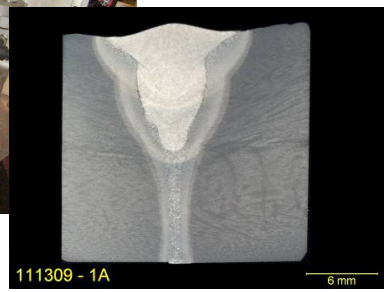
EWI - Laser-Arc Hybrid
Pipeline Girth Welding

Increasing requirements for safety, cleanliness, and reliability of the nation's pipeline system are driving new technology needs for managing legacy systems and improving new pipelines

- Oil & Gas: Heerema, Exxon, Posco, Global Industries, ConocoPhillips, J.Ray McDermott, Tenaris Tamsa, Chevron Energy Technology,
- DOT Regulator: DOT Office of Pipeline Safety
- DOT Stakeholder – DOT RSPA
- Regulatory Body: US Dept. of Transportation – Pipeline and Hazardous Safety Administration
- Welding Equipment: CRC-Evans, Lincoln Electric
- System Development and Evaluation: EWI







- Designed and built prototype system using off-the-shelf equipment
- Demonstrated system on current highest performance pipeline steels;
  - Reached travel speeds at 4X current state of practice
  - Currently preparing to move forward on higher-strength steels
- Also working additional joint DOT-industry programs
  - Phased-array ultrasonic nondestructive evaluation
  - Automated corrosion damage assessment and repair system
  - Advanced strain-based design methods for higher-strength pipeline systems

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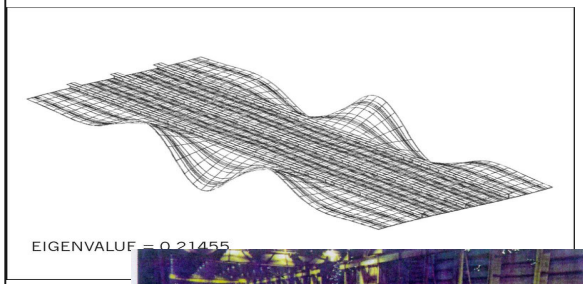
Navy Joining Center (NJC)
Distortion Control of Thin Steel Structures

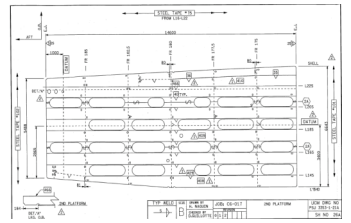
Improved manufacturing processes and technologies to reduce welding distortion in shipbuilding.

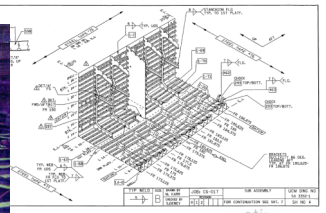
Objective:
- Analyze and assess panel designs and manufacturing and assembly processes
- Apply new technologies and procedures to reduce distortion
- Incorporate technologies and lessons learned into upcoming ship design methodologies and shipyard panel line investments.

Performing Activities:
- Navy Stakeholders - PEO Carriers, PMS 500, PMS 400
- Navy Regulators - NAVSEA 05D3, 05P; NSWC-CD Code 611
- Shipbuilders – Newport News Shipbuilding, Northrop Grumman Ship Systems, General Dynamics - BIW
- EWI - Project Mgt; Distortion prediction, reduction technologies

Estimated Payoff(s):
- Cost for Distortion Mitigation (per ship)
  - CVN 78 - $6M;
  - DDG-1000 - $1.5M;
  - DDG-51 - $0.5M
- Fitting and assembly costs (per ship)
  - CVN 78 - $6M;
  - DDG-1000 - $5M;
  - DDG-51 - $5M
- Cost for Production Schedule Disruption (per ship)
  - CVN 78 - $13.4M;
  - DDG-1000 - $13.5M;
  - DDG-51 - $5M
- Life-Cycle Costs: DDG-51- 10 percent reduction in crew complement per ship, due to reduced maintenance at sea.







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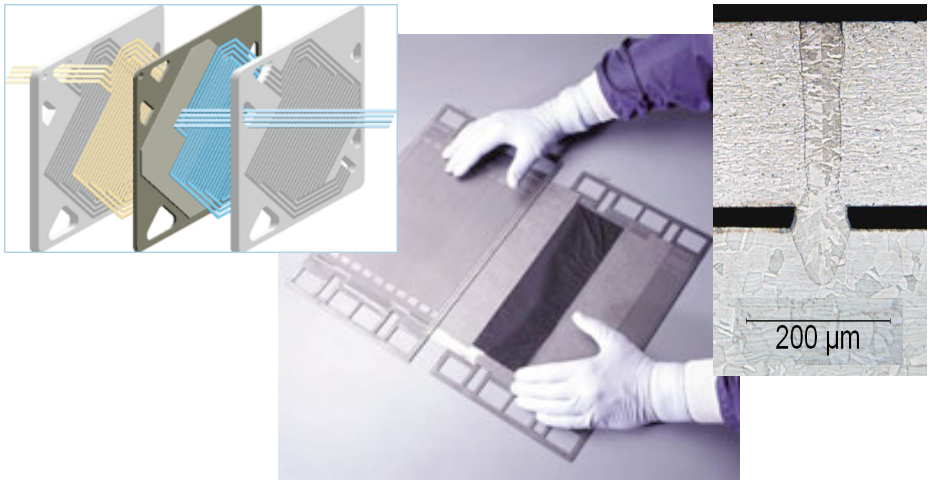
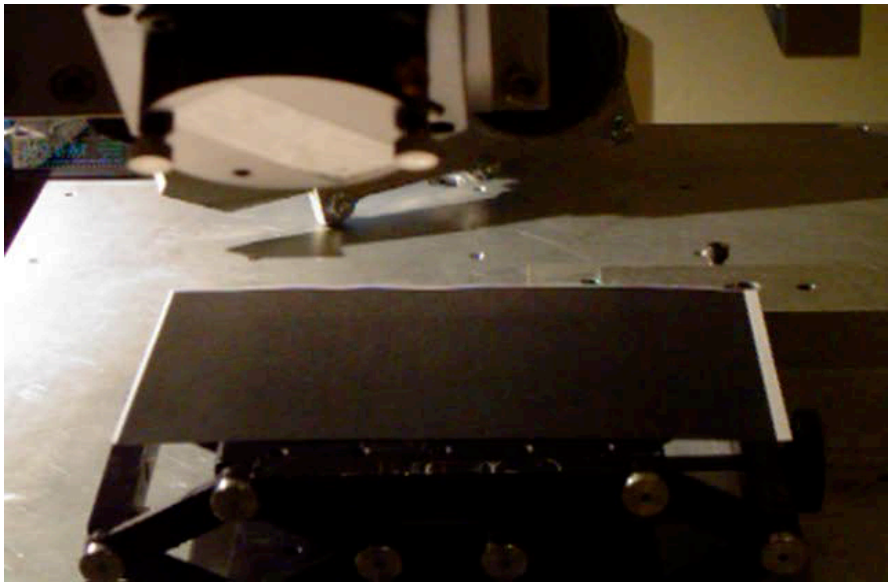
Edison Advanced Energy Center
High-Speed Manufacturing of Fuel Cells

Fuel Cell Systems Depend on “Stacks”
- Precision formed and welded sheet metal
- High-performance alloys

One Fuel Cell Vehicle Platform
- 100,000 units/year
- 400 bi-polar plates per vehicle
- ~1 meter of laser weld / bi-polar plate
- 40 Million meters of weld per year
- Beyond conventional production technology





Under ODOD Edison Program
- Designed and built high-speed demonstration cell with fiber laser
- Welding speed over 2 meters per second
- Accommodates a variety of fuel-cell relevant materials with good gap tolerance.
- High speed fiber laser welding offers excellent promise for fuel cell component fabrication.
- Coupled with precision forming simulation to provide design and prototype capability

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Corridors of Opportunity

Ohio and Midwest Manufacturers are Uniquely Positioned to Help Put This Vision on Track

$357 Billion

By 2050

~$8.1b / year

investment

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The Mandate

Making Sure Ohio and Midwest Manufacturers Can Fill the Gap in the HSR Supply Chain

- By the Federal Railroad Administration's own assessment little has been done to prepare American manufacturers to meet the standards and successfully compete for high speed rail opportunities *(FRA Five Year Strategic Plan)*

- A cottage industry is emerging to secure *Buy American* waivers for America's high speed rail development

The good news: There's time to bring Ohio and Midwest manufacturers on board …*if* we act now

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Compare and Contrast

Europe and America's Comparative Commitment to HSR Manufacturing Readiness

EURNEX – **Eu**ropean **R**ail Research **N**etwork of **EX**cellence

- A focus on **innovation and solutions**
- Twenty countries; 47 research institutions focused on ***new materials*** *and* ***manufacturing technologies***
- *A proven* ***Rolling Stock research program*** *focused on safety , comfort, reliability and affordability*

The Federal Railroad Administration/other Federal Agencies

- **No coherent policy agenda or emphasis** on HSR manufacturing technology
- According to a recent TRB memo: *"the [FRA Strategic] plan should be revised or it will risk setting back progress in deployment on HSR*"

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The Unique Role of the High Speed Rail Manufacturing Center

The Center will:

Maximize the role of Ohio and Midwest manufacturers' in developing America's high speed rail network and increasing the system's overall affordability by:

- Developing and strengthening American supply chains.
- Helping remove and minimize manufacturing technology and standards obstacles to *buying American.*
- Fostering public/private partnerships to accelerate globally-competitive high speed rail supplier technology commercialization.

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The Unique Role of the High Speed Rail Manufacturing Center

- Informing FRA and professional society rule making and standards development with American manufacturing competitiveness in mind.

- Collaboratively developing and deploying affordable advanced manufacturing methods and materials that meet the evolving needs of American HSR.

- Tightening suppliers' learning curves and shortening time to market.

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The Center's Agenda
Some Immediate Challenges

- American OEMs must be pre-qualified within three years to be ready to complete key route segments.

- Inconsistent international and nonexistent American manufacturing standards mean missed opportunities for potential Ohio and Midwest suppliers. Examples:

  - *Crashworthiness rules*
  - *Lightweight materials and structural designs*
  - *Passive safety features*
  - *Life-cycle monitoring and management*
  - *New materials and manufacturing technology*

- Very limited American university focus on rail manufacturing technologies.

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The Opportunity for Ohio

As a Ohio-based, Midwest-focused Center with national scope, the opportunity will emerge to:

- **Identify** early the Ohio manufacturers with capacity, skills and assets to secure a place in the HSR supply chain and pending technical and regulatory impediments to HSR deployment
- **Solve** technology challenges for Ohio manufacturers that will deliver competitive advantage.
- **Advocate** for national and international technical standards that benefit Ohio companies and their workers.
- **Position** Ohio, both technically and politically, as key allies for European and Asian OEMs seeking American suppliers and sub-contractors.

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The Next Steps

- Find ways to include the Center as a critical part of Ohio development and rail policy and planning.
- Identify federal, multi-state and private opportunities to integrate the Center into policy, funding streams and public/private R&D agendas.
- Immediately begin a manufacturing/engineering codes and standards review study and identify initial supply chain challenges.

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Questions?

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